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RESEARCH PAPER

Sex and educational attainment differences in HPV knowledge and vaccination awareness among unvaccinated-sexually active adults in Puerto Rico

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ABSTRACT

Human papillomavirus (HPV) knowledge and HPV vaccination uptake remain suboptimal. We assessed sex and educational attainment differences in HPV knowledge and vaccine awareness. Data from a cross-sectional study (2018–2021) in Puerto Rico among adults aged 21–49 was analyzed ($n = 278$). Adequate knowledge was defined as a score of ≥70% of correct responses on a 13-item knowledge scale. Multivariable logistic regression was used to assess the association of sex (men vs. women) and education (high school or less vs. more than high school) categories with adequate HPV knowledge and vaccine awareness. Adequate HPV knowledge was higher among women (53%) and men (46%) with more than high school and was lower among women (46%) and men (27%) with high school or less. For HPV vaccine awareness, similar results were observed. Women (OR = 3.0 ; 95%CI = 1.4–6.2) and men (OR = 2.3 , 95%CI = 1.1–4.8) with more than high school and women with high school or less (OR = 2.3 , 95%CI = 1.0–5.2) were more likely to have adequate HPV vaccine knowledge than men with high-school or less education. Heightened HPV vaccine awareness was also seen among more educated women and men and women with similar lower education when compared to men with ≤ high school. Men and individuals with lower educational attainment were more likely to have inadequate HPV knowledge and vaccine awareness. HPV vaccine-oriented educational interventions should target these high-risk groups.

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HPV; education; vaccination; knowledge; awareness; men; women

Introduction

Human papillomavirus (HPV) is one of the most common sexually transmitted infections (STI).[1] The worldwide burden of HPV-related cancers is high, the majority occurring in less developed regions.[2] It is estimated that high-risk HPVs are responsible for 5% of all cancers worldwide, including cervical, anal, oropharynx, penile, vaginal, and vulvar cancers.[2,3] There are three prophylactic vaccines for the prevention of HPV, which target viral strains associated with HPV-related cancers and genital warts.[4] The first HPV vaccine was made available in the United States (U.S.) in 2006.[5] In the U.S., nanovalent HPV vaccination is recommended for children and adults aged 9–26 years and approved to be administered up to 45 years old,[4] and is the only HPV vaccine currently available. Only 21.5% of adults aged 18–26 years in the U.S. received the recommended HPV vaccine doses in 2018.[6] Based on the 2020 U.S. National Immunization survey, among adolescents 13–17 years in Puerto Rico, 75.1% had at least one dose, and 58.6% had completed the vaccination series.[7]

Since the introduction of the HPV vaccine, a decrease in infection rates among younger people, especially among girls and young women, has been observed. These efforts have significantly reduced precancerous lesions and genital warts, and in the future, fewer people will develop cancers linked to HPV.[8] In October 2018, the U.S. Food and Drug Administration announced the expansion of the approved age for HPV vaccination up to 45 years. In June 2019, the Advisory Committee on Immunization Practices (ACIP), a key advisory committee for the U.S. Centers for Disease Control and Prevention (CDC), recommended the vaccine for all men and women up to age 26 and advised adults between 27 and 45 to ask their doctor's advice about getting the vaccine because it could be beneficial. Getting vaccinated later in life can still reduce the risk of getting HPV infection, and this population would benefit from the vaccine.[9,10] A recent US study evidenced that expanding HPV catch-up vaccination programs through age 45 would provide public health benefits and showed cost-effectiveness improvements up to that age particularly in women.[10,11] While not all studies have seen similar findings, this catch-up recommendation calls for further research on HPV vaccine uptake and awareness among adults.[10,11]

To increase HPV vaccination coverage among adults, adequate HPV and vaccine knowledge is needed. A 2020 study in the U.S. found that awareness of HPV infection and the HPV vaccine has declined over the past years; racial minorities, rural

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residents, men, those aged 65 years and older, and those with the lowest educational and socioeconomic standing are the most affected.[12] Another study in the U.S. found that men have the erroneous perception that HPV-related cancers mainly affect women. However, men have been disproportionately affected by oral, oropharyngeal, and anal cancers.[13] Likewise, HIV-infected and uninfected men attending STI clinics in Puerto Rico revealed poor awareness of HPV and the HPV vaccine in 2009–2010.[14,15] Therefore, community knowledge and awareness of HPV and prevention are still inadequate and insufficient.[16] Given recent expansions in HPV vaccinations among adults aged 27–45, recent research in the U.S. has focused explicitly on assessing HPV and HPV vaccine knowledge among this population sub-group, showing higher awareness among women and more educated individuals.[17]

Multiple efforts have been performed in Puerto Rico to increase HPV vaccine uptake, including educational campaigns, outreach activities, and policies that support HPV vaccination access.[18–20] However, understanding factors currently associated with lack of knowledge is essential to develop educational programs about HPV vaccination that will help reduce public skepticism and clarify misinformation about HPV vaccination.[18–21–23] After 16 years of introducing HPV vaccines in the U.S. and Puerto Rico, it is essential to understand if a lack of knowledge about HPV infection and HPV vaccination persists among young and middle-aged adults.[24] This information will allow us to develop better intervention strategies to increase the still reduced vaccination uptake, especially among men compared to women.[16] While previous studies have evaluated the association of sex and educational attainment on HPV knowledge and awareness, information on their combined impact is limited and relevant to further understanding gender and social disparities.[16,17,25] Thus, this study assessed the combined influence of sex and educational attainment on HPV knowledge and vaccine awareness among a sample of unvaccinated adults in Puerto Rico and the reasons for HPV vaccine hesitancy. The identification of groups that continue to have low vaccination awareness allows us to assess progress and develop targeted HPV vaccine-oriented educational interventions.

Methods

Study population

The study population consisted of sexually active and HPV-unvaccinated adults between 21 to 49 years old who participated in the study "Cross-Sectional Associations of Oral Microbiota with Oral HPV Infection Among High-Risk Hispanic Adults." Recruitment of participants initiated on 26 November 2019 and was completed on 30 April 2021. Participants who met any of the following criteria were excluded from the study: pregnancy, breastfeeding, hormonal contraceptive use, postmenopausal status, history of HPV vaccination, post-traumatic stress disorder, depression, HIV infection, antibiotic use in the two preceding months, factors preventing a valid, complete periodontal exam (less than four teeth and orthodontic appliances), and conditions that may place participants at risk (cardiovascular diseases and bleeding disorders). Most exclusion criteria, such as pregnancy, breastfeeding, hormonal contraceptive use, and postmenopausal status, were identified as variables affecting the association between oral microbiota and oral HPV in the parent study. The study was promoted in various STI clinics, on social media (Facebook, Instagram, and Twitter), and on TV and radio stations. Individuals expressing interest in participating called the study contact information to undergo eligibility screening; those deemed eligible were given an appointment to complete study procedures at the research clinic. Patients attending the STI clinics were approached to invite them to participate in the study (over two-thirds of participants were recruited at these clinics). Those deemed interested were assessed for eligibility and given the option of completing the survey in the clinic or scheduling an appointment to attend the research clinic.

Out of 300 participants recruited for the parent study, 20 had been vaccinated against HPV infection, and two did not have information on education status. These were excluded from the current analysis, leaving a final analytical sample of 278 participants. The Institutional Review Board of the University of Puerto Rico Comprehensive Cancer Center approved this study. All participants gave written and verbal consent before completing the study procedures.

Data collection

Participants completed a face-to-face interview, asking about demographic, clinical, and behavioral characteristics. They also answered questions about their knowledge and attitudes toward HPV infection and the vaccine. Sexual behavior and drug use were collected using an audio computer-assisted self-interview (ACASI).

Variables

This study evaluated three outcomes: (1) HPV awareness, (2) HPV vaccine awareness, and (3) adequate HPV knowledge. The first two outcomes, HPV and HPV vaccine awareness, were defined using the following questions: *"Before today, have you ever heard of the Human Papillomavirus or HPV?"* and "*There are two vaccines to prevent HPV infection called cervical cancer vaccines or HPV vaccines. Before today, have you ever heard of the cervical cancer vaccine or HPV shot*?" Participants who responded affirmatively to these questions were considered HPV aware and HPV vaccine aware, respectively. Adequate knowledge was defined as having at least nine correct responses on a 13-item knowledge scale (approximately a score of ≥70%). The items included within the scale included: 1) Do you think HPV can cause cervical cancer?; 2) Do you think you can get HPV through sexual contact?; 3) Do you think HPV can go away on its own, without treatment?; 4) Do you believe that having sex with multiple people increases your risk of getting HPV?; 5) Do you think that starting sex

before age 16 increases your risk?; 6) Do you think having a partner who has had many sexual partners increases your risk of getting HPV?; 7) Do you think condoms always prevent the transmission of HPV from one person to another?; 8) Do you think that people who are infected with HPV usually know they are infected?; 9) Do you think HPV infection is rare?; 10) Do you think HPV causes genital warts?; 11) Do you think HPV infection increases the risk of anal cancer?; 12) Do you believe HPV infection increases the risk of oral cancer?; 13) Do you believe that people infected with HPV always have symptoms?. (Supplemental Table S1). A similar scale was used and validated in a previous study.[14] Participants were also asked reasons why they have not been vaccinated against HPV.

The main predictor variables of this study were sex (men, women) and educational attainment (≤high school, >high school), while a combination of these (≤high school/men, ≤high school/women; >high school/men, and >high school/women) was used to assess its association with the study outcomes. Potential confounders included age (continuous), marital status (single, married/consensual union, divorced/separated), healthcare insurance (yes, no); income (<$20,000, ≥$20,000), smoking status (never, current, former), alcohol consumption (never, at least one drink last year, binge drinking), and lifetime number of sexual (1–10, ≥11) and oral sexual partners (1–10, ≥11).

Statistical analysis

Frequency distributions were used to describe study participants' demographic, lifestyle, and clinical characteristics. The chi-square statistic was used to assess differences in the three outcomes evaluated by sex and education separately and in combination. Multivariable logistic regression evaluated the association of sex and education categories with adequate HPV knowledge and vaccine awareness. The main reasons for not getting the HPV vaccine were reported by sex, education, and the combination of both. Stata version 16 (StataCorp LLC, College Station, TX) was used for data management and analysis.

Results

Sociodemographic characteristics

Participants had a mean age of 33 years, 53% were men, and 60% were single. Most participants had health insurance (81%), one-fourth were current smokers (24%), and nearly half were binge drinkers (45%). Half of the participants with higher education had insurance (50%), while most women, regardless of education, and men with lower education had insurance (>80%). Most men (36%) and women (38%) with lower education were current smokers when compared to men (19%) and women (11%) with higher education; meanwhile, men, regardless of education, had a higher number of lifetime sexual partners and oral sexual partners than women regardless of education (Table 1).

HPV knowledge and vaccination awareness

More women reported being aware of the HPV vaccine (69% vs. 42%, $p < .05$) and had adequate HPV knowledge than men (50% vs. 39%, $p = .05$, Figure 1(a)). In addition, adults with more than high school reported being aware of HPV (92% vs. 80%, $p < .05$), the HPV vaccine (67% vs. 36%, $p < .05$), and had an adequate HPV knowledge (49% vs. 36%, $p < .05$) than adults with high school education or less (Figure 1(b)).

Table 1. Participants' sociodemographic, lifestyle, and clinical characteristics by combined categories of sex and education among unvaccinated Hispanic adults. (n = 278).

		≤High school/GED		>High school/GED		
HPV-related risk factors	N (%)	Men *n*=55	Women *n*=52	Men *n*=92	Women *n*=79	*P*-value
Age (years); mean ± SD	32.9 ± 7.9	32.7 ± 8.3	32.0 ± 9.0	32.7 ± 6.7	33.8 ± 8.0	.61
Marital status						
Single	166 (59.7)	32 (58.2)	37 (71.1)	54 (58.7)	43 (54.4)	.06
Married/Consensual union	78 (28.1)	15 (27.3)	10 (19.2)	22 (23.9)	31 (39.2)	
Divorced/Separate	34 (12.2)	8 (14.5)	5 (9.6)	16 (17.4)	5 (6.3)	
Health insurance						
No	33 (19.1)	6 (14.3)	5 (11.6)	18 (40.9)	4 (9.1)	<.05
Yes	140 (80.9)	36 (85.7)	38 (88.4)	26 (50.1)	40 (90.9)	
Annual income						
<$20,000	186 (72.7)	41 (82.0)	39 (86.7)	56 (63.6)	50 (68.5)	.01
≥20,000	70 (27.3)	9 (18.0)	6 (13.3)	32 (36.4)	23 (31.5)	
Smoking status						
Never	186 (67.1)	30 (54.5)	28 (53.8)	63 (69.2)	65 (82.3)	<.05
Current	67 (24.2)	20 (36.4)	20 (38.5)	18 (19.8)	9 (11.4)	
Former	24 (8.7)	5 (9.1)	4 (7.7)	10 (11.0)	5 (6.3)	
Alcohol consumption						
Never	47 (16.9)	5 (9.1)	15 (28.8)	8 (8.7)	19 (24.0)	<.05
At least one drink last year	107 (38.5)	20 (36.4)	17 (32.7)	37 (40.2)	33 (41.8)	
Binge drinking	124 (44.6)	30 (54.5)	20 (38.5)	47 (51.1)	27 (34.2)	
Lifetime number of sexual partners						
1–10 partners	134 (52.8)	20 (40.8)	33 (67.3)	25 (30.9)	56 (74.7)	<.05
≥11 partners	120 (47.2)	29 (59.2)	16 (32.6)	56 (69.1)	19 (25.3)	
Lifetime number of oral sexual partners						
1–10 partners	194 (70.3)	35 (64.8)	43 (82.7)	50 (54.3)	66 (84.6)	<.05
≥11 partners	82 (29.7)	19 (35.2)	9 (17.3)	42 (45.6)	12 (15.4)	

Missing values: income (n = 22); smoke status (n = 1); lifetime number of sexual partners (n = 24); lifetime number of oral sexual partners (n = 2).

When evaluating the combination of sex and educational attainment, we observed higher HPV awareness among men with higher education (93%). In contrast, the lowest HPV awareness was observed among men with lower education (78%, $p < .05$). In addition, the highest vaccine awareness was observed among women with higher education (81%) and the lowest vaccine awareness among men with lower education (22%, $p < .05$). For adequate HPV knowledge, similar results were observed, with the highest adequate knowledge among women (53%) and men (46%) with more than a high school education and lower among women (46%) and men (27%) with high school or lower education ($p < .05$, Figure 1(c)).

Men with high school or lower education had substantial lower knowledge concerning the following statements when compared to women with higher education: (1) HPV can cause cervical cancer (49% vs. 85%, $p < .05$), (2) You can get infected through sexual contact (55% vs. 82%, $p < .05$), (3) HPV can disappear without treatment (14% vs. 27%, $p < .05$), (4) People that are infected usually know that are infected (56% vs. 83%, $p < .05$), (5) HPV is uncommon (42% vs. 75%, $p < .05$), (6) Genital warts are caused by HPV (33% vs. 54%, $p < .05$), (7) People that are infected with HPV always present symptoms (44% vs. 77%, $p < .05$, Supplemental Table S1).

Association of HPV infection, vaccination awareness, and knowledge and sex and education

After adjusting for age and medical insurance coverage, women (OR = 4.0; 95% CI = 1.4–11.4) and men (OR = 2.9; 95% CI = 1.1–7.8) with more than high school education were more likely to have HPV awareness than men with a high school education or less. Higher HPV vaccine awareness was also seen among more educated women (OR = 15.3; 95% CI = 6.5–35.9) and men (OR = 4.3; 95% CI = 2.0–9.3) and women with similar lower education (OR = 3.7; 95% CI = 1.6–8.6) when compared to men with high-school or lower education. Similar results were found when evaluating adequate knowledge. Women, regardless of education level, and men with more than high school education, were more likely to have adequate knowledge than men with high school or lower education (Table 2).

Main reasons for vaccine hesitancy

The main reason reported by all groups for being unvaccinated was a lack of knowledge; although this reason was more frequently reported by men (85%) and women (56%) with lower education as compared to men (49%) and women (32%) with higher education ($p < .001$). Lack of access to get the vaccine was the second reason reported by both men with lower (11%) and higher education (16%). Disagreement or no interest in the vaccine was the second reason for women with high school or lower education (14%). For women with higher education, age-related reasons was the second most reported reason for not getting the vaccine (they were too young or too old to have the vaccine, 23%) (Table 3). Similar findings were observed in sub-analyses exclusively among individuals aged 21–45 (n = 235, data not shown).

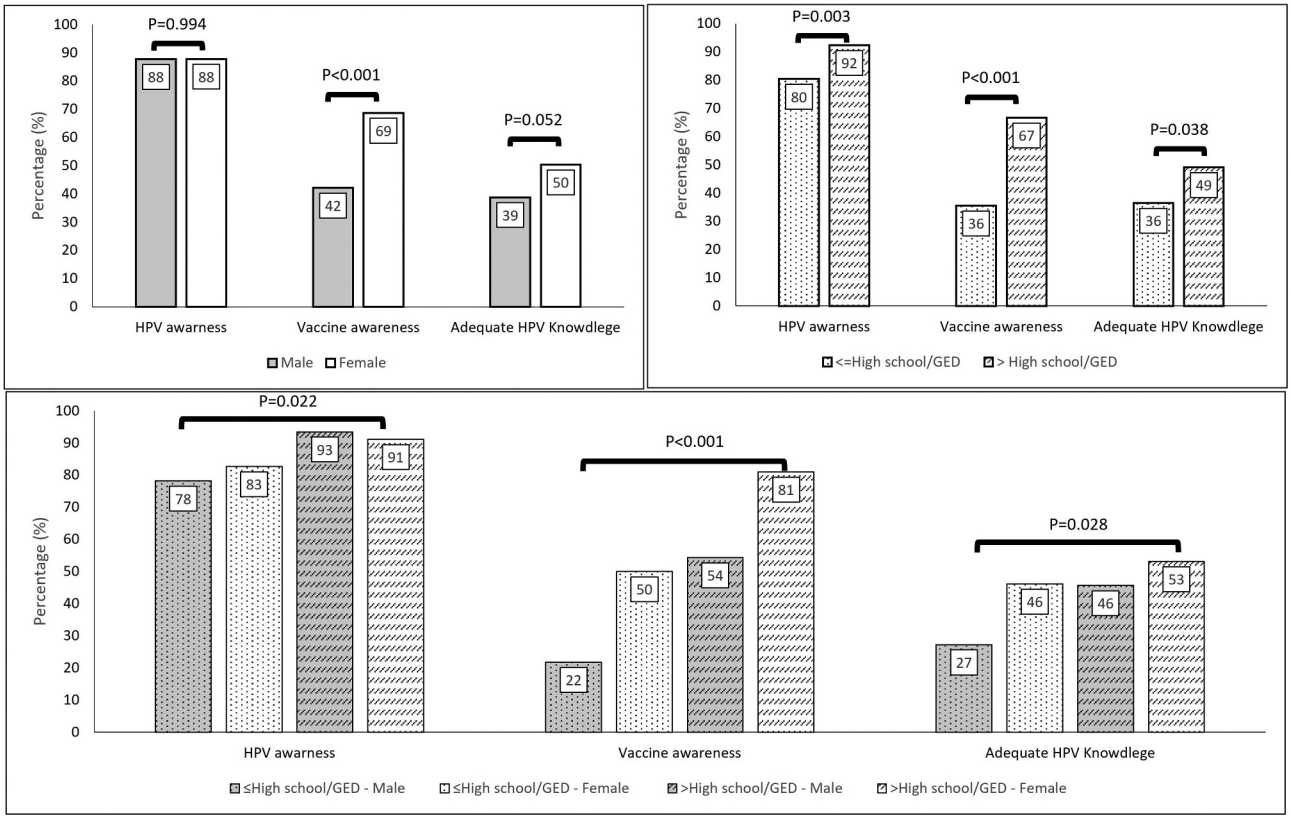

Figure 1. HPV, HPV vaccine awareness, and adequate HPV knowledge by sex, education, and combined categories of sex and education among unvaccinated Hispanic adults.

Table 2. Association of HPV infection, HPV vaccine awareness, and adequate HPV knowledge and combined categories of sex and education among unvaccinated Hispanic adults.

Education and sex categories	*N* (%)	Crude OR (95% CI)	Adjusted OR (95% CI)*
HPV awareness			
≤High school/GED—Men	43 (78.2)	Reference	Reference
≤High school/GED—Women	43 (82.7)	1.33 (0.51–3.49)	1.33 (0.51–3.49)
>High school/GED—Men	86 (93.5)	4.00 (1.40–11.39)	4.00 (1.40–11.39)
>High school/GED—Women	72 (91.1)	2.87 (1.05–7.85)	2.87 (1.05–7.84)
HPV vaccine awareness			
≤High school/GED—Men	12 (21.8)	Reference	Reference
≤High school/GED—Women	26 (50.0)	3.58 (1.54–8.30)	3.70 (1.59–8.64)
>High school/GED—Men	50 (54.3)	4.26 (1.99–9.12)	4.33 (2.02–9.30)
>High school/GED—Women	64 (81.0)	15.29 (6.52–35.83)	15.27 (6.49–35.94)
Adequate HPV knowledge			
≤High school/GED—Men	15 (27.3)	Reference	Reference
≤High school/GED—Women	24 (46.1)	2.28 (1.02–5.12)	2.30 (1.03–5.16)
>High school/GED—Men	42 (45.6)	2.24 (1.09–4.61)	2.24 (1.09–4.62)
>High school/GED—Women	42 (53.2)	3.03(1.44–6.34)	3.00 (1.43–6.29)

*Age and medical insurance coverage.

Discussion

This study assessed sex and educational attainment differences in HPV knowledge and vaccine awareness among a sample of unvaccinated adults in Puerto Rico. We found that adequate HPV knowledge was higher among women (53%) and men (46%) with higher education and lower among women (46%) and men (27%) with a high-school education or less. In addition, similar results were observed in terms of HPV vaccine awareness, with the highest awareness among women with higher education. In comparison, the lowest awareness was seen among men with lower education. Men with the lower educational attainment had the lowest levels of knowledge and awareness compared to the other comparison groups. These findings were similar to a previous study in Brazil where HPV knowledge differed by sex, and lower education level was the variable most interfered with knowledge.[25] In a survey conducted in the US in 2018 among adults ($n = 725$) aged between 27–45 years, 72.9% were aware of HPV, and 67.1% were aware of the vaccine; however, only 36.1% knew that HPV could cause non-cervical cancers.[17] In the study, respondents were more likely to be aware of HPV and HPV vaccination if they were female, had a higher level of education, and had previous cancer information-seeking behaviors.[17]

This study is the first study evaluating the combined influence of sex and education attainment on HPV knowledge and vaccine awareness among unvaccinated adults in Puerto Rico. Previous studies in Puerto Rico had evaluated HPV awareness, HPV vaccine awareness, and adequate HPV knowledge (Table 4), permitting us to assess changes in these outcomes over time. Overall, comparisons across studies show that increases in HPV awareness have occurred over the past decade, although these still seem to lag in men. Furthermore, HPV vaccine awareness is still limited. In 2008, Reyes et al. reported very low HPV and HPV vaccine awareness in a sample of adults from the general population (37% and 33%, respectively), although Morales-Campos et al. showed much higher awareness among women in 2009 (89% and 67%, respectively). A survey conducted among Hispanic women in the San Juan metropolitan area from 2010 to 2013 found that HPV vaccine awareness was low among women (64.8%); only 39.6% of the sample had learned from a physician about the HPV vaccine availability.[26] A survey in 2014 about HPV among adults in Puerto Rico found that 66% of women aged 18–34 were aware of the HPV vaccine; however, only 14.7% reported HPV vaccination. Of these, 50.7% completed all doses required.[27] While higher awareness levels are documented in our study (2019–2021), among men, cross-sectional studies in Puerto Rico among men attending STI clinics from 2009 to 2011 revealed poor awareness of HPV (53.3%) and the vaccine (28.3%). Of those with HPV awareness, only 29.3% had adequate HPV knowledge.[14,15] On the other hand, 88% of men were aware of HPV, and 39% were aware of the vaccine's availability, suggesting there has been some limited progress in vaccine awareness among men.

Table 3. Main reasons for not getting the HPV vaccine among unvaccinated sexually active Hispanic adults (n = 278).

		≤High school/GED		>High school/GED		
Reasons for not getting the HPV vaccine	Overall *n* (%)	Men *n* (%)	Women *n* (%)	Men *n* (%)	Women *n* (%)	*P*-value*
Lack of knowledge	146 (52.5)	47 (85.4)	29 (55.8)	45 (48.9)	25 (31.6)	<.001
Age-related reasons	35 (12.6)	1 (1.8)	5 (9.6)	11 (12.0)	18 (22.8)	.003
Lack of access	35 (12.6)	6 (10.9)	4 (7.7)	15 (16.3)	10 (12.7)	.488
Disagree or not interested	19 (6.8)	1 (1.8)	7 (13.5)	5 (5.4)	6 (7.6)	.106
Not at high risk	17 (6.1)	2 (3.6)	0 (0.0)	9 (9.8)	6 (7.6)	.092
Medical provider did not recommend it	17 (6.1)	2 (3.6)	3 (5.8)	7 (7.6)	5 (6.3)	.810
Infected with HPV	10 (3.6)	2 (3.6)	1 (1.9)	1 (1.1)	6 (7.6)	.125

Table 4. HPV awareness, HPV vaccine awareness and adequate HPV vaccine knowledge from previous studies in Puerto Rico.

	Study characteristics								HVP knowledge		
Reference	Period	Sex	Age group (years)	Sample size	Study population	HPV awareness	HPV vaccine awareness	Adequate HPV knowledge	Cause cancer	Sexually transmitted	Disappear without treatment
Current study	2018–2021	Men	21-49	147	General population	88%	39%	42%	64%	69%	18%
		Women		131		88%	50%	69%	79%	80%	18%
Roura-Monllor et al.[28,]	2013–2015	Women	>21	418	Colposcopy clinics	81%	79%	-	82%	86%	-
Romaguera et al.[20]	2010–2013	Women	16-64	566	General population	82%	65%	-	-	-	-
Rios-Vazquez et al.[27]	2014	Women	18-44	1,108	General population	89%	-	-	-	-	-
Colón-López et al.[17]	2013	Men and women	>21	200	Federal Qualified Clinic	88%	-	-	-	-	-
Colón-López et al.[15]	2009–2010	Men	18-26	46	STI clinic	-	28%	-	-	-	-
Rivera- Acosta et al.[29]	2009–2010	Women	>15	147	Center for inflammatory bowel diseases	77%	58%	-	81%	58%	-
Colón- López et al.[14]	2009–2011	Men	>16	206	STI clinic	52%	-	29%	77%	86%	30%
Morales-Campos et al.[24]	2009	Women	>18	417	General population	89%	67%	-	89%	78%	8%
Reyes et al.[25]	2008	Men and women	15-74	573	General population	37%	33%	-	86%	73%	-

Previous studies have documented the importance of community health education from the state health departments, physicians, and STI clinic venues for prevention efforts.[14] In this study, awareness and adecuacy of HPV knowledge among both men and women was lower in individuals with lower education. Furthermore, women with higher education were much more likely to have HPV and HPV vaccine awareness and adecuacy than men with lowest education. Thus, our findings demonstrate that individuals with lower educaiton, and particullarly men with lower education should be a target for future HPV prevention educational efforts and interventions. Furthermore, sex and educational attainment differences in knowledge and awareness could impact HPV-related cancer prevention and occurrence disparities, highlighting the relevance of continued research and interventions.

The main reasons reported in our study for vaccine hesitancy were lack of knowledge (reported by over half of the study population), age-related reasons, and lack of access. The main reasons men with lower education reported were lack of knowledge and access. These findings highlight the importance of education and increasing access to the vaccine (i.e., health care coverage, information on vaccination venues) among interested individuals. Given that age related reasons were also reported as a barrier, education of the potential benefits of vaccination up to the age of 45 and the need to discuss the topic with their physician should be increased. Previous studies also have found that adults were more likely to be vaccinated against HPV infection (1) if a physician suggested it, (2) if they were informed about the vaccine's importance, or (3) if their medical insurance covered it.[15,23,30,31] Our study found that lack of medical provider recommendation was one reason for being unvaccinated, suggesting that some participants had not been educated or advised about HPV infection and prevention.

Our results indicate that more resources could be directed toward educating patients about HPV infection and prevention methods, i.e., how common it can be, the relevance and availability of HPV vaccination, its association with cancer, and HPV-related cancer screening and diagnostic testing.[18] Vaccine education is essential because it may have an impact not only on adult vaccination but also on their receptivity to vaccinate their children, supporting that primary care physicians incorporate discussions of HPV vaccination to target patients as a standard of care.

Legislation has been passed in Puerto Rico for health insurance to cover the HPV vaccine until the age of 18 and to make the HPV vaccine a school-entry requirement among adolescents aged 11–12 years.[18,20] As more evidence supports the benefits of catch-up vaccination, additional legislation could consider the coverage of HPV catch-up vaccination for adults 26 to 45 years old, particularly among high-risk groups. However, it is vital to understand why people are not being vaccinated and identify groups with limited information about HPV to develop adequate and more effective educational campaigns.[26]

Study strengths and limitations

Although these results are important for the progress and improvement of HPV-related cancer prevention and control efforts in Puerto Rico, the study findings should not be extrapolated or generalized to the general population. The study had multiple exclusion criteria, which could have hampered the recruitment process where some high-risk people could not be recruited. Despite this, the data collected may allow approaching targeted high-risk groups more efficiently. While our study population resulted in a reduced sample size of some sub-groups used for analysis, this study increases our understanding of sex and educational attainment differences in HPV knowledge and awareness. It provides insights into which groups will have the most significant benefit from interventions.

Conclusion

This study supports previous findings of low awareness of HPV infection and vaccination among unvaccinated individuals in Puerto Rico, with the poorest results among less educated individuals, particullarly among men. Increasing HPV and HPV vaccination awareness among men and lower educated individuals are essential; these high-risk populations should be targeted at the population level and in relevant clinical settings.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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